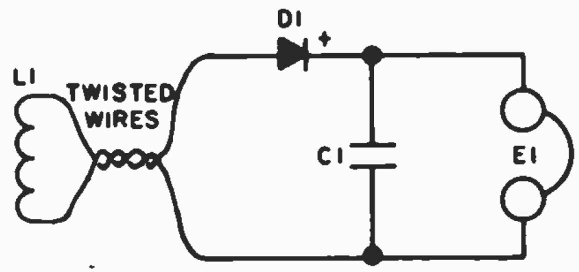
B1—Battery, 9 VDC, type 2U6 or equiv.
M1—Meter, 0-1-mA DC

56 Simple AM Mod. Monitor

☐ This simple modulation monitor for AM ham or CB transmitters requires no connection to the transmitter. Just position the loop near the final tank or antenna matching coil until the signal is heard in the headphones.

PARTS LIST FOR SIMPLE AM MOD. MONITOR

C1—100-pF disc capacitor
D1—1N914 diode
E1—Magnetic headphone, 2000 ohms or better
L1—Coil, 3 turns on 1½-in. dia. form, use any thin gauge wire



Prehistoric Radio!

If you've been following the "Below 500 kHz" column, you know that natural phenomena right here on earth have been producing, transmitting, and receiving radio signals since time began. Lightning bolts, and some other mighty reactions in nature, produce great amounts of electromagnetic radiation in the light, heat, and the radio portions of the electromagnetic-wave spectrum. Lightning discharges from tropical storms in particular are continually producing wide-band radio waves that propagate worldwide. You receive these signals as bothersome static noise on the LF, MF, and on HF bands.

Weak-signal operators who do moon-bounce work are only too well acquainted with the radio signals which our own sun transmits. These noisy signals can totally mask over moon-bounce signals when the sun and moon are both in the same direction from moon-bouncer's antenna. Radio waves known as "cosmic noise" are continually bombarding our antennas with radio signals generated by natural reactions occurring in galactic space. As a matter of fact, the discovery that the source of this particular radio noise lay outside our solar system marked the beginning of radio astronomy. In radio astronomy, naturally occurring radio signals from space are studied in an attempt to learn more about the cosmos.

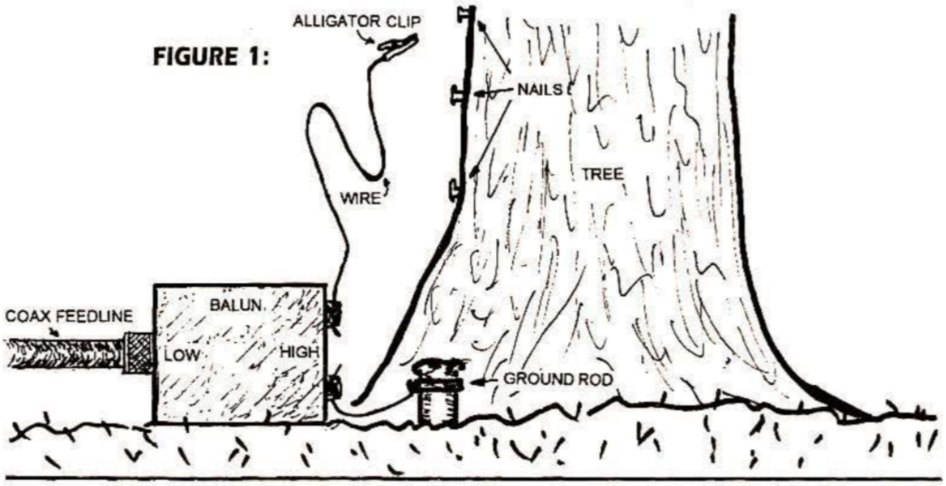
OK, so there were radio signals before we were around to know about it, but what about the reception of those waves? Who received those signals? No person received them, but they were received by every naturally-occurring conductor to which they propagated. And, once trees evolved, they provided natural, grounded-vertical Marconi antennas to receive these waves.

Well, but where was the receiver for those antennas? The resistance of the tree's "body" was the "receiver." This resistance dissipated much of the received energy as heat rather than as sound, like the loudspeaker does in our HF receivers.

Of course, natural transmission and reception still goes on today. Have you asked the trees near your home if they have received any RF signals lately? I have. And the trees which I asked told me that they receive lots of signals—and I haven't gone off my rocker! They receive lightning-generated signals just as they have since time immemorial, and they also receive the signals which man puts onto the airwaves today.

How did I ask the trees? It's simple. I just connected a feedline to a tree, and connected the line to my receiver. I received a multitude of signals across the LF, MF, and HF bands. If I had tried other bands I would have, no doubt, received signals on those bands, too. As a matter of fact, a tall, live tree makes a decent LF-MF-HF antenna.

FIGURE 1:



Connecting a feedline to a tree antenna. Nail small, thort, thin nails into the tree about every two or three feet, up to 10 or 15 feet high. Connect the clip to the various nails until best results are achieved. The balun is a 4:1 ratio or higher, high side to the tree.

Tree-Antennas Throughout Radio's History

Old time radio expert Squires reported using trees as receiving aerials for distances of 50 kilometers. His method was to hammer a nail into the tree a few yards above the ground, and connect the receiver's antenna input connectors to the nail and to a ground.

Texanna Loomis, daughter of wireless communication pioneer Mahlon Loomis, says in her *Radio Theory and Operating* that "It has been found that a tree can be used for a receiving antenna, preferably an oak, by attaching a lead-in wire to the trunk of the tree."

Another old-time radio expert named Morecroft felt that reception came from the lead-in wire, rather than the tree itself. In my own tests I can't agree with Morecroft, because my lead-in was shielded, grounded coax, the attachment connectors to the tree were short, and the antenna performed much more like a long antenna than a short stub.

In more recent times there have also been reports of tree antennas. Cohen, in the April 1996 issue of *73 Magazine*, reports using a tree antenna on VHF and UHF with "mediocre-to-good results," but no acceptable results for lower bands. Perhaps his use of trees only 20 feet tall limited their performance on lower bands.

Also in *73* (May 1990), JA6HW and JA6AUI report using a 12 foot high tree for both transmitting and receiving on the 10 meter band with good results. Their article also says that hams used live-tree antennas in the 1930's, as did the U. S. Forces in Vietnam. In *Monitoring Times*, April 1989, Dr. Kosta reports that trees "frequently work better than conventional antennas" for television reception. In the September 1990 issue of *Monitoring Times* yours truly reports good results with a tall maple tree on LF through HF.

Tapping into Natural Radio

Figure 1 shows suggestions on utilizing a tree as an antenna. For HF, I suggest using the tallest tree available. Perhaps shorter trees would be better for VHF-UHF as in the 1990 *73* article discussed above—or perhaps not. As with any outside antenna it is wise to utilize some form of lightning protection.

RADIO RIDDLES

Last month:

I said, "Let's say that we could stain some radio waves, frozen at one moment in time, with some kind of dye so that we could actually see them. Of course we can't do this, except in our imagination. But if we did, how would the waves appear to us?"

For the area occupied by the waves at any one instant in time we would be trying to visualize the variations in the signal's electrical-field strength, and the reversals in field orientation (showing when the RF current changes direction of flow twice each cycle). This wouldn't look like a wavy line, or a sine wave graph as is represented in most texts on radio.

One way to imagine seeing the frozen waves is to envision that the space which the radio waves fill will show a darker shade of gray where their field strength is more intense, and a lighter shade where their field strength is weaker. For simplicity, let's consider only direct-wave propagation with no reflections or other impediments to the wave's travel between the transmitting antenna and receiving antenna.

In the space between the two antennas we would see bands of differing shades of gray oriented at right angles to the wave's direction of travel. There would be darker bands, less dark bands just next, even less dark bands next till a relatively light shade of gray was reached. Then somewhat darker bands, then even darker bands, and on to produce a sort of zebra-skin look. The darkest bands would be a half wavelength apart as would the lightest ones.

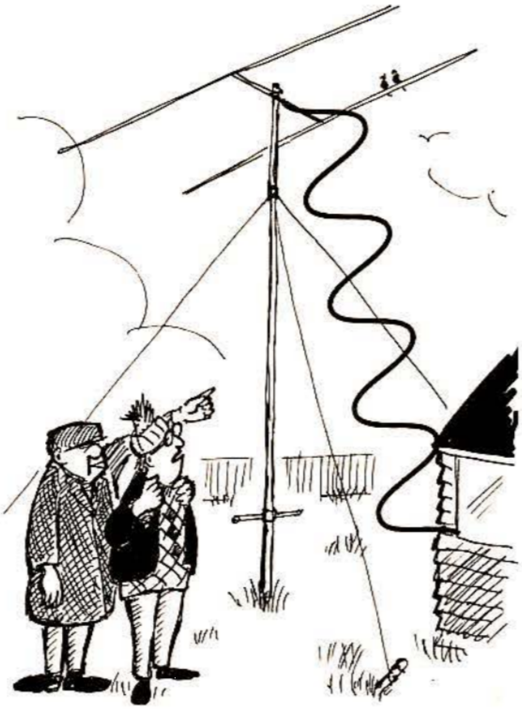
If we added a green tinge to our gray to indicate one orientation of the electrical field, and a red tinge for the field's other orientation then, starting at the middle of a darker band there would be greenish gray for a half wavelength along the direction of wave travel, a reddish gray for the next half wavelength, and so on.

Of course this picture is an over-simplification. For instance, we haven't talked about the wave's magnetic field, the polarization of the wave, or the spherical shape of the wavefront. But this simplified picture does cover the basic idea of radio waves in space.

This Month:

Let's say that, instead of freezing the waves, we had the advanced eyes and brains of some specialized android so that we could actually watch radio waves zip along on their 186,000 miles per hour flight from the transmitting antenna to our receiving antenna? How would those rascals look then?

You'll find an answer for this month's riddle, and much more, in next month's issue of *Monitoring Times*. 'Til then Peace, DX, and 73.



"You know, I thought those were classic standing radio waves until I read Clem Small's column this month. Now, I don't know what the heck they are!"

17

Solar TV Reception Booster

Here is a versatile rooftop TV reception booster that will add a full 18 dB of gain to the incoming TV signals at your receiver. This means no more ghosts, clearer pictures, and perhaps even reception of a distant station you could not get before. Best of all, this gadget is powered by an inexpensive solar cell that will virtually run forever without requiring replacement. Additionally, the circuit is designed with a charger circuit and reserve pack.

You can build it as is, or only include as much as you would like. For example, if you break the circuit where the X's are indicated, your booster will thrive entirely off its solar battery. If you break it at the two Y's, the solar cell charges a 4½-volt battery pack during the day so the booster will work just as well at night as in direct sunlight. If you include all the circuit (taking into account the indoor AC supply shown), you can occasionally recharge the 4½-volt pack just in case you have had a protracted period of rain or overcast weather which prevented the solar cell from sending its energy down to the reserve battery.

Construction is not complicated, but since you are dealing with both vhf and uhf signals, you will have to keep all leads extremely short and direct. In fact, you would do best to cram the parts close together so as to cut down on the length of interconnecting wires. Looking at the schematic, you will note that Q1 must be grounded; this is no problem; however, since the HEP-3 comes with four leads instead of the regular three. Turning the transistor

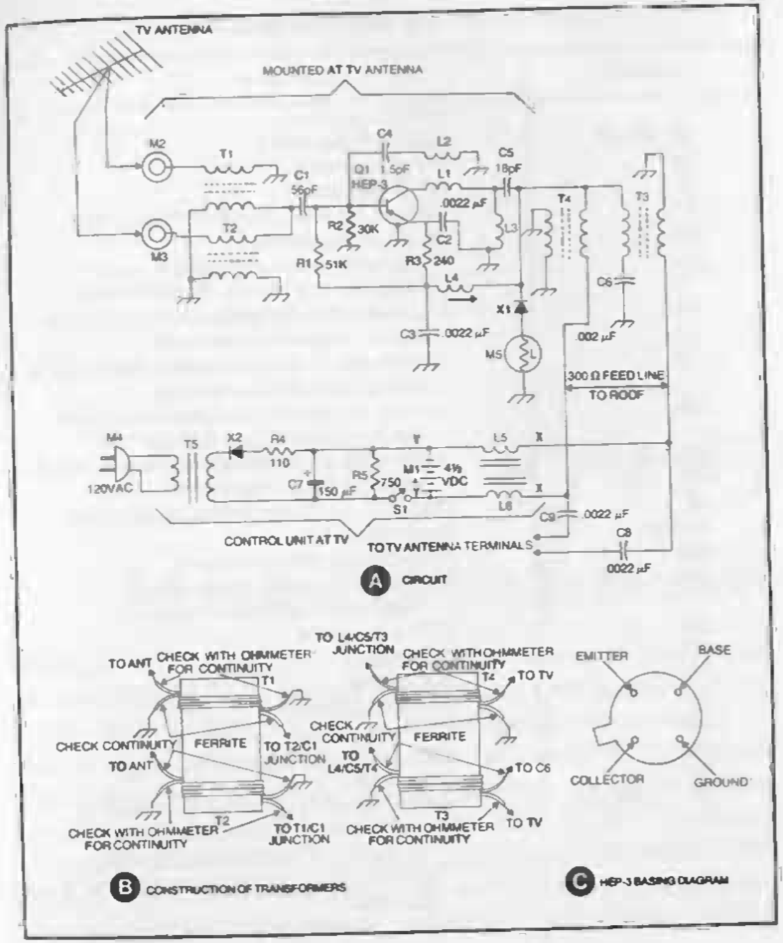


Fig. 17. Solar TV reception booster.

upside down, you will notice an arrangement of leads as shown and identified in Fig. 17.

Take care in constructing your coils that you duplicate exactly those turns and techniques recommended in Table 17.

Once complete, you can test out your booster by hooking it to the TV set and placing a lit 60-watt lamp bulb in rather close proximity to M5. As the lamp is turned on, you should get a much-improved picture. Adjust the best reception on all channels by tuning L4 and the coupling between L1 and L2. Now mount at the TV antenna, positioning M5 for best sunlight hits.

Hint: Leave the AC plug plugged in at all times. It will not draw power until you throw switch S1 onto "charge."

Table 17. Parts List for Solar TV Reception Booster.

Item No.	Description
C1	56-pF capacitor.
C2, C3, C6	.0022-μF capacitors.
C4	1.5-pF capacitor.
C5	18-pF capacitor.
C7	150-μF, 15-w VDC electrolytic capacitor.
C8, C9	.0022-μF capacitors.
L1	7½ turns No. 24 enameled wire, evenly wound on a 3/16-inch-diameter form.
L2	3 turns No. 24 enameled wire evenly wound on a 3/16-inch-diameter form.
L3	17 turns No. 24 enameled wire evenly wound on a 3/16-inch-diameter form.
L4	11½ turns of No. 24 enameled wire evenly wound on Speer Type E ferrite form.
L5, L6	10 turns No. 24 enameled wire evenly wound on Speer Type E ferrite form.
M1	4½ VDC, with three penlites of NiCd cells.
M2, M3	Binding posts.
M4	AC wall plug with cable clamp.
M5	4½-VDC Solar pack. (International Rectifier No. SP5G26C or equiv.)
Q1	HEP-3 transistor.
R1	51K resistor.
R2	30K resistor.
R3	240-ohm resistor.
R4	110-ohm resistor.
R5	750-ohm resistor.
S1	Spst switch.
T1, T2, T3, T4	Using Ferroxcube K5050-06 ferrite cores, insert 2 turns of special 300-ohm miniature twinlead in each form hole. Pull tight, and connect leads where shown in diagram.
T5.	6.3-VAC filament trnasformer. (Triad F-14X or equiv.)

18

Free-Power AM Radio Receiver

Strange as it may seem, this transistor broadcast-band radio receiver "steals" power from one station to give to another! The principle is basic: By tuning the battery-section antenna coil (L2) to the strongest broadcast station on the band, diode X1 can rectify the rf and convert it into DC current. Naturally, the closer you are to a strong station, the more current the "radio battery" section of your radio receiver will be able to supply. Once you have found this spot, the DC current is passed on to power the transistor circuit which acts as a genuine receiver, with the full tuning it affords. See Fig. 18 and Table 18.

The basic consideration is a good antenna and ground, the latter preferably being made to a water pipe or solid external ground composed of a pipe driven at least 4 feet into moist earth. This procedure not only ensures maximum signal pickup for the radio-battery portion of the circuit, but also provides best results for the GE-2 receiver circuit.

Once completed, just tune the radio battery as explained in the first paragraph and calibrate your receiver by adjusting L1 so that the bottom of the band occurs when C1 is fully meshed. If you have a local broadcast station operating near 540 kHz, this simplifies things tremendously. Once the calibration procedure is complete, forget entirely about adjusting L1 and do all your listening by tuning C1.

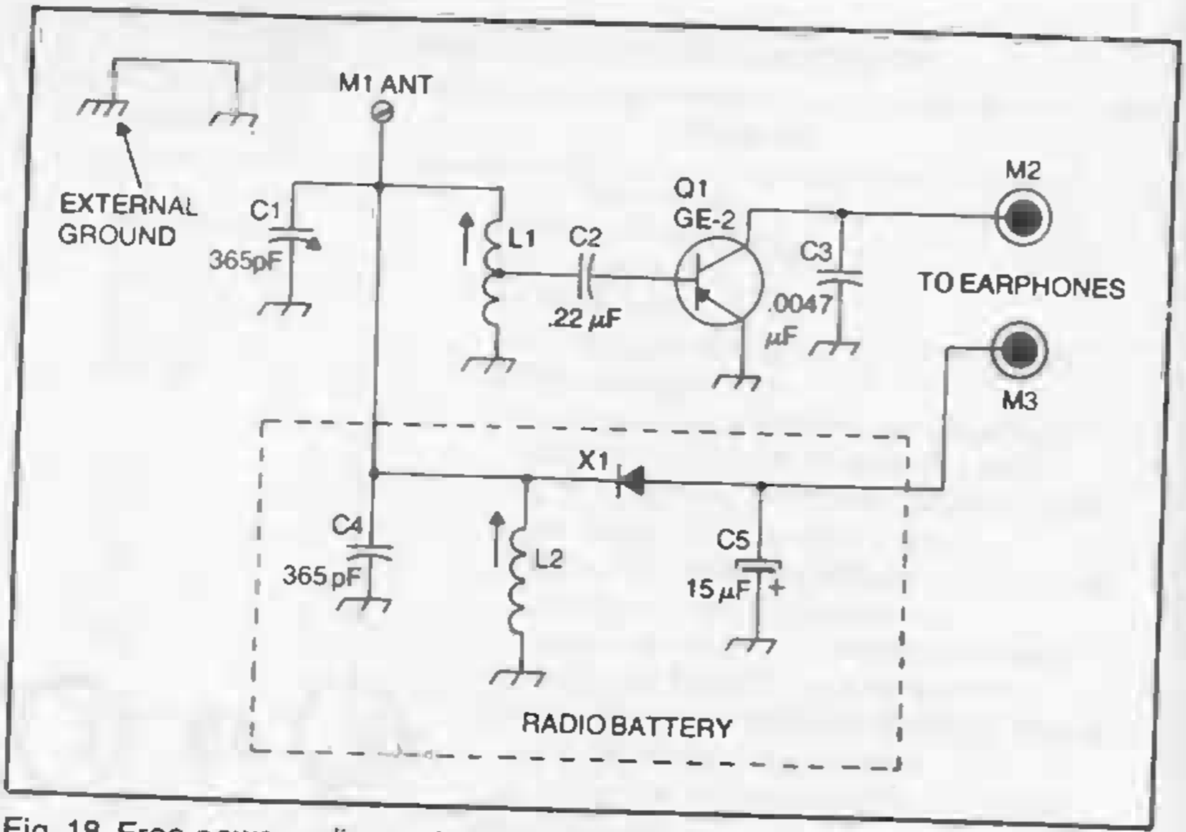


Fig. 18. Free-power radio receiver.

Table 18. Parts List for Free-Power AM Radio Receiver.

Item No.	Description
C1, C4	365-pF variable capacitors.
C2	.22-µF capacitor.
C3	.0047-µF capacitor.
C5	15-µF, 6-w VDC electrolytic capacitor.
L1, L2	Loopsticks. (Superex VLT-240 or equiv.)
M1	Binding post.
M2, M3	Test jacks.
Q1	GE-2 transistor.
X1	1N38B diode.